Living & Working for a Sustainable Future

Module: Energy, Me & My Work

Learner Study Guide

nscc
School of Trades and Technology

Learning Outcomes

Upon successful completion of this unit, you will be able to:

1. Analyze the importance of action relating to the responsible use, management, production and consumption of energy.

Learning Activities

To complete this unit, students should:

- ✓ Complete the activities outlined in step 1: Looking Back
- ✓ Complete the activities outlined in step 2: Looking Within
- ✓ Complete the activities outlined in step 3: Looking Forward
- ✓ Submit the required assessment components to your facilitator

	**Looking Back: INFORMATION & EXPERIENCE**

NSCC's mission, vision and strategic plan are fundamentally aligned with the principles of sustainability. The College is committed to taking a leadership role in the journey toward sustainability for the benefit of all Nova Scotians. NSCC programs help learners to be able to apply sustainable practices that support economic, social, cultural and environmental stewardship.

This module relates to the responsible use, management, production and consumption of energy.

Think about what you know about energy already. Try to recall personal experiences relating to the use, perhaps the management and production and, no doubt, the consumption of energy.

Internet Research Activity: An Internet Scavenger Hunt

Take Action by using the Internet to discover answers to the questions on the following page. See these questions as items on an Internet Scavenger Hunt. Be sure to keep track of your references and sources of the information. It is important to know where the information is coming from to ensure it is a credible source.

Question one:

Provide definitions for the following terms:

a) Energy
b) Renewable energy
c) Global warming
d) Global warming predictive models

Energy relates to the capacity to do work and it has to do with both motion and activity. Energy comes in many different shapes and sizes: mechanical energy, elastic energy, potential energy, kinetic energy, surface energy, sound energy, gravitational energy, thermal energy, electric energy, electrostatic energy, electricity, magnetic energy, electromagnetic energy, chemical energy, nuclear energy, light energy the list goes on.

In today's world, we are also increasingly concerned with and aware of RENEWABLE ENERGY forms - things such as wind power, water power, solar energy, liquid biofuels, solid biomass, biogases, geothermal energy, this list continues to grow and evolve too.

The outcome for this module is to analyze the importance of action relating to the responsible use, management, production and consumption of energy. It makes sense to start at the personal level – your own life and experiences relating to energy use. Think about your own personal energy consumption. Think about how you use energy.

Energy, in terms of Physics, is the amount of work done by a force. Some commonly recognized forms of energy include;

- Heat (Thermal)
- Mechanical
- Electrical

Energy production often involves complex interactions between thermal, mechanical and electrical equipment.

Energy comes from a number of sources and can be transferred, transformed and transmitted to meet the needs of an end user. It is important to note

that energy can never truly be created or destroyed. It is merely changed from one form to another.

Non-Renewable Sources of Energy

The use, management, production and consumption of non-renewable sources of energy posses a significant impact on the global environment. Many common methods of energy production involve the consumption of fossil fuels, such as petroleum products, natural gas & coal, which generate greenhouse gasses. The need to reduce the emission of greenhouse gases which are directly linked to the warming of the Earth's atmosphere is a major societal concern.

Other environmental impacts associated with the consumption of energy include things such as:

- Fresh water consumption
- Generation of hazardous waste by-products
- Dispersion of harmful air contaminants (NOx, SOx & Particulate Matter)
- Depletion of natural resources
- Reduction of ecological diversity & available habitat

Right now, Nova Scotia's domestic energy supply (renewable and non-renewable) is small compared to its energy imports. The majority of Nova Scotia's energy supply is imported in the form of coal and petroleum products which are used primarily for electrical generation and transportation.

Renewable Sources of Energy

Now moving onto renewable sources of energy , a renewable energy resource is one whose use does not affect its future availability. Examples of renewable resources include:

- Wind
- Solar
- Hydro
- Biomass
- Geothermal
- Others…

Nova Scotia is actively pursuing a number of renewable energy projects, most notably, hydro, wind and tidal power. Also, a very common source of renewable thermal energy is the use of domestic wood stoves and furnaces. Renewable energy technologies transform a renewable energy resource into useful heat, cooling, electricity or mechanical energy.

Some renewable energy resources cease to be renewable when they are abused. Trees, for example, can provide a renewable supply of biomass for

combustion, but not if forests are not managed properly and the rate of harvest leads to deforestation.

Although renewable energy technologies provide an environmentally benign, socially responsible source of energy there are a number of downsides which include:

- High initial cost
- Variable supply
- Low power density

Energy Conservation

Energy conservation refers to the practice of decreasing the quantity of energy consumed in a process or system.

Energy conservation may be achieved through efficient use of energy, in which case consumption is reduced while achieving a similar outcome. Examples of efficient energy use include:

- High-efficiency engines
- Compact fluorescent lighting
- Increased thermal resistance (e.g. insulation and air sealing)

Another common method of conserving energy is through the reduction of actual units or material within a process or system. Examples of energy reduction methods:

- Fewer lights in a manufacturing plant or better control of their use
- Mass transit
- Material substitutions

Energy conservation may result in an initial increase of financial capital but should also result in an increase of environmental value, national security, personal security, and human comfort.

Efficient use of energy allows all end users a low cost alternative to replacing or increasing expensive infrastructure and provides significant reductions in:

- Resource consumption
- Greenhouse and other harmful emissions
- Improved system performance

Physical, financial, environmental and social objectives can be met using a wide variety of energy options. In general, these options can be grouped into one of four broad categories:

1. Conservation through behavioural changes
    - *Use existing supply or technology differently*

2. Conservation by replacing end-use technology
    - *Optimize the system or process to use less energy*

3. Conservation by replacing energy conversion technology
    - *Replace equipment with a higher efficiency model*

4. Replacing existing energy sources with alternatives
    - *Move to renewable energy without reducing total consumption*

Some things to think about:

- ☐ Energy, in all of its forms, is essential to all societies. The associated environmental and social impacts of energy consumption will be one of humanities most important problems to overcome.
- ☐ Sustainability of the world's natural resources and access to stable energy supplies will be determining factors to the success of future generations.
- ☐ Whether the end-use is heating, cooling or power generation, all energy systems have opportunity for improvement.
- ☐ Although existing systems using non-renewable resources may play a significant role in the deterioration of the global environment they provide a stable and reliable source of energy for the immediate short term.
- ☐ The replacement of any energy system with an alternative or renewable source should always follow or occur in conjunction with the application of energy conservation.
- ☐ Improving systems to perform more efficiently will provide industry and individuals with a more cost effective and sustainable solutions.

Now that you have gone through a quick tour of some of the ideas and concepts to consider with regards to energy, now it is time to consider some outside sources and their tips for responsible use, management, production and consumption of energy.

Explore the Provincial Government Perspective:

Nova Scotia Department of Energy
http://www.gov.ns.ca/energy/

Conserve Nova Scotia
http://www.conservens.ca/

Nova Scotia's Climate Change Action Plan - Toward a Greener Future
https://www.gov.ns.ca/energy/resources/spps/energy-strategy/Energy-Strategy-2009.pdf

Explore the Federal Government Perspective:

Canadian Office of Energy Efficiency
http://www.oee.nrcan.gc.ca/english/index.cfm

Council of Energy Ministers – "Moving Forward on Energy Efficiency in Canada: A Foundation for Action
http://www.nrcan-rncan.gc.ca/com/resoress/publications/cemcme/cemcme-eng.pdf

Natural Resources Canada – Energy Page
http://www.nrcan-rncan.gc.ca/com/eneene/index-eng.php

Eco Action – Using Less – Living Better
http://www.ecoaction.gc.ca/

Other Perspectives:
Kimmins, James Peter; Lord, Marcia (2001). "The Ethics of energy: a framework for action / L'Ethique de l'énergie: un cadre d'action" - UNESCO: 49 pages.
http://unesdoc.unesco.org/images/0012/001235/123511eo.pdf

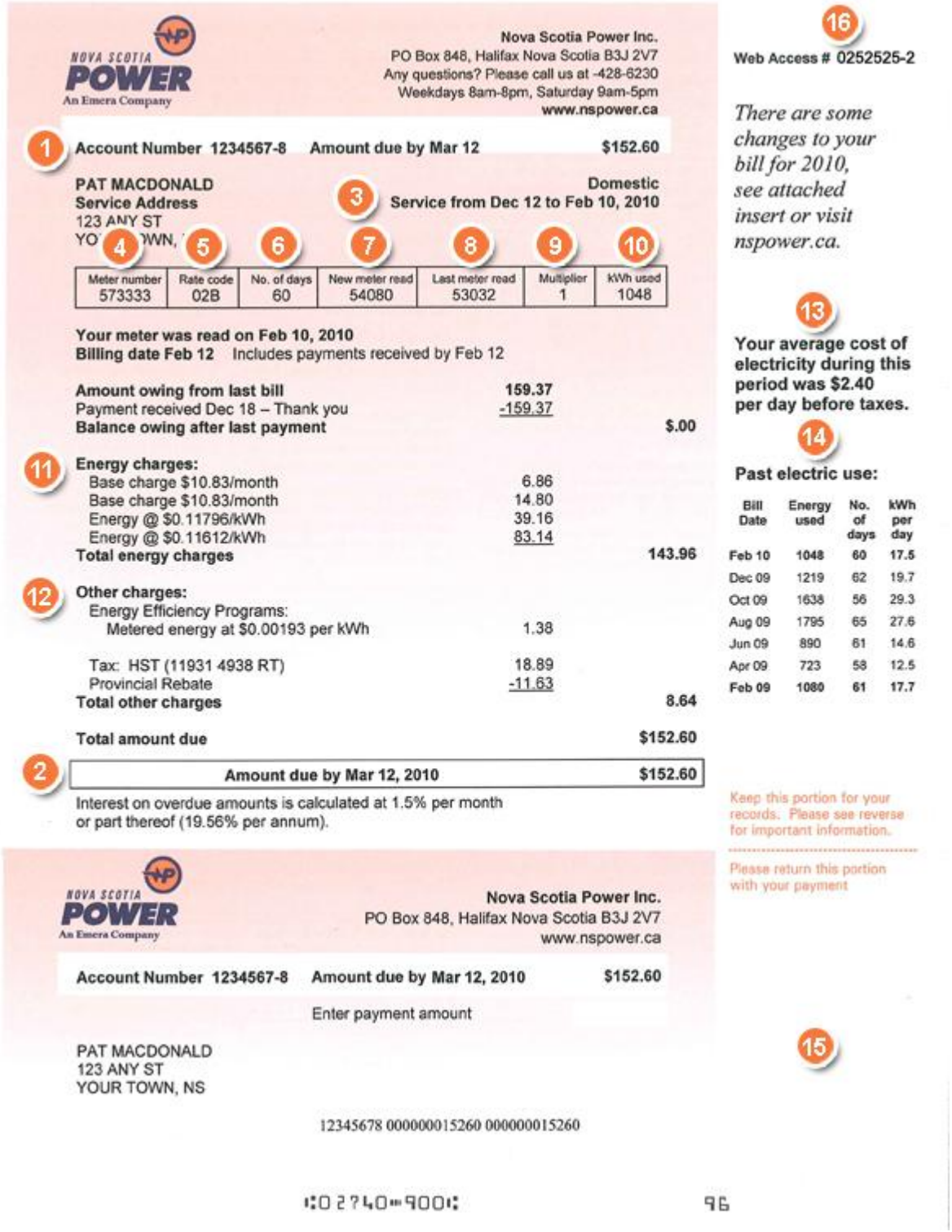
Renewable Energy World – Website
http://www.renewableenergyworld.com/rea/home

Based on your readings and explorations, think about how energy is used, produced, managed and consumed in your home, in your community, in your province, in your country, in our world. There is a lot to think about, and a lot that can be done regarding energy use, production and management.

	**Looking Within: REFLECT & SHARE**

Now that you have thought about what energy is and sources of energy, consider your interactions with energy at a very practical level - your bill. In this province, Nova Scotia Power (NSP) is a public utility and is regulated under the Public Utilities Act and the Nova Scotia Utility and Review Board (NS UARB). The UARB has supervisory powers over NSP operations and expenditures. NSPower serves many different customer groups, which include residential, commercial and industrial. Residential customers include personal use in homes, condominiums, apartments. Commercial customers include larger group uses for educational institutions, businesses, retail stores, office buildings and this includes classifications of small, medium, large. Industrial customers include those using electricity as an energy source in manufacturing (includes classifications of small, medium, large and

extra large). There are also other classifications including charitable organizations, street and recreational lighting. Let's start with a sample residential bill...



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Nova Scotia Power Inc.
PO Box 848, Halifax Nova Scotia B3J 2V7
Any questions? Please call us at -428-6230
Weekdays 8am-8pm, Saturday 9am-5pm
www.nspower.ca

16 Web Access # 0252525-2

There are some changes to your bill for 2010, see attached insert or visit nspower.ca.

1 **Account Number 1234567-8** **Amount due by Mar 12** **$152.60**

PAT MACDONALD
Service Address
123 ANY ST
YO WN,

3 Domestic
Service from Dec 12 to Feb 10, 2010

4 Meter number	5 Rate code	6 No. of days	7 New meter read	8 Last meter read	9 Multiplier	10 kWh used
573333	02B	60	54080	53032	1	1048

Your meter was read on Feb 10, 2010
Billing date Feb 12 Includes payments received by Feb 12

Amount owing from last bill	**159.37**	
Payment received Dec 18 – Thank you	-159.37	
Balance owing after last payment		**$.00**

11 **Energy charges:**

Base charge $10.83/month	6.86	
Base charge $10.83/month	14.80	
Energy @ $0.11796/kWh	39.16	
Energy @ $0.11612/kWh	83.14	
Total energy charges		**143.96**

12 **Other charges:**

Energy Efficiency Programs:		
Metered energy at $0.00193 per kWh	1.38	
Tax: HST (11931 4938 RT)	18.89	
Provincial Rebate	-11.63	
Total other charges		**8.64**

Total amount due **$152.60**

2 **Amount due by Mar 12, 2010** **$152.60**

Interest on overdue amounts is calculated at 1.5% per month or part thereof (19.56% per annum).

13 **Your average cost of electricity during this period was $2.40 per day before taxes.**

14 **Past electric use:**

Bill Date	Energy used	No. of days	kWh per day
Feb 10	1048	60	17.5
Dec 09	1219	62	19.7
Oct 09	1638	56	29.3
Aug 09	1795	65	27.6
Jun 09	890	61	14.6
Apr 09	723	58	12.5
Feb 09	1080	61	17.7

Keep this portion for your records. Please see reverse for important information.

Please return this portion with your payment

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Account Number 1234567-8 **Amount due by Mar 12, 2010** **$152.60**

Enter payment amount

15

PAT MACDONALD
123 ANY ST
YOUR TOWN, NS

12345678 000000015260 000000015260

⑆02740⑈900⑆ 96

1.Account Numbers
Account numbers are assigned with each new account. Your account remains the same even when the address changes for the account.

2.Please Pay By
The date and amount of the total payment due. This amount includes current charges plus any arrears or credits.

3.Service From
The dates of service covered by this bill.

4.Meter Number
This unique number identifies your meter. The meter number is usually six digits. No other meter has the same number.

5.Rate Code
Identifies the rate classification used for billing your service.

6.No. of Days
Total number of days in this billing period.

7.New Meter Reading
Your most recent meter reading for the meter listed.

8.Last Meter Reading
Your meter reading at the time of your last billing or connection. Subtract this from your present reading to determine the amount of electricity used during this billing period.

9.Multiplier
The amount of electricity used is determined by multiplying the difference between the present and previous reading by the multiplier showing on your electric bill.

10.Kwh Used
The total number of kilowatt hours used during this billing period.

11.Energy Charges
A breakdown of your energy charges in kilowatt hour usage for the current billing period.

12.Other Charges
This section shows any applicable charges for street lights, water heaters or heating systems financed through NSPI, service charges, adjustments, taxes, etc...

13.Your Average Cost
A calculation of the average daily cost for electricity.

14.Past Electric Use
A comparison of your usage over the past year.

15.Remittance Stub
Detach this piece and send it in if you are mailing in a cheque.

16.Web Access Number
You can use this number for register for e-bill a service that delivers your power bill to your e-mail address and saves paper.

There is also important information listed on the reverse side of a bill.
The following information is found on the back of the printed paper bill.

Rates and Regulations:
The rates and regulations for selling power are approved by the Nova Scotia Utility and Review Board. Complete copies of our Rates and Regulations are available here.

Rate Codes and Symbols:

Domestic Rates
* B – Bi-monthly
* M – Monthly
* S – Seasonal
* 01-07 - Residential
* 06 – Residential Time of Day
* 09 – Wind Generation

As of January 2010, NSP statements include a new fee. These dollars help Nova Scotia meet its future energy needs in an environmentally responsible way. The funds will be used to offer electricity saving programs for consumers, from residential to small business to large industry. NS Power has created, administered and offered energy efficiency programs to Nova Scotians for the past several years and is transitioning this responsibility over to Efficiency Nova Scotia, a new government agency. Energy efficiency programs help Nova Scotians save money, reduce emissions, protect the environment, and reduce our provincial carbon footprint.

Time of Day Rates work in conjunction with electric thermal storage heating systems. This results in electricity use during times of the day when the cost of energy is less than the standard rate.

Billing date is the day we print your bill. Your bill includes the payments we have received and electricity you have used since your last bill.

Energy charge is the price you pay for the electricity (kWh's) you have used.

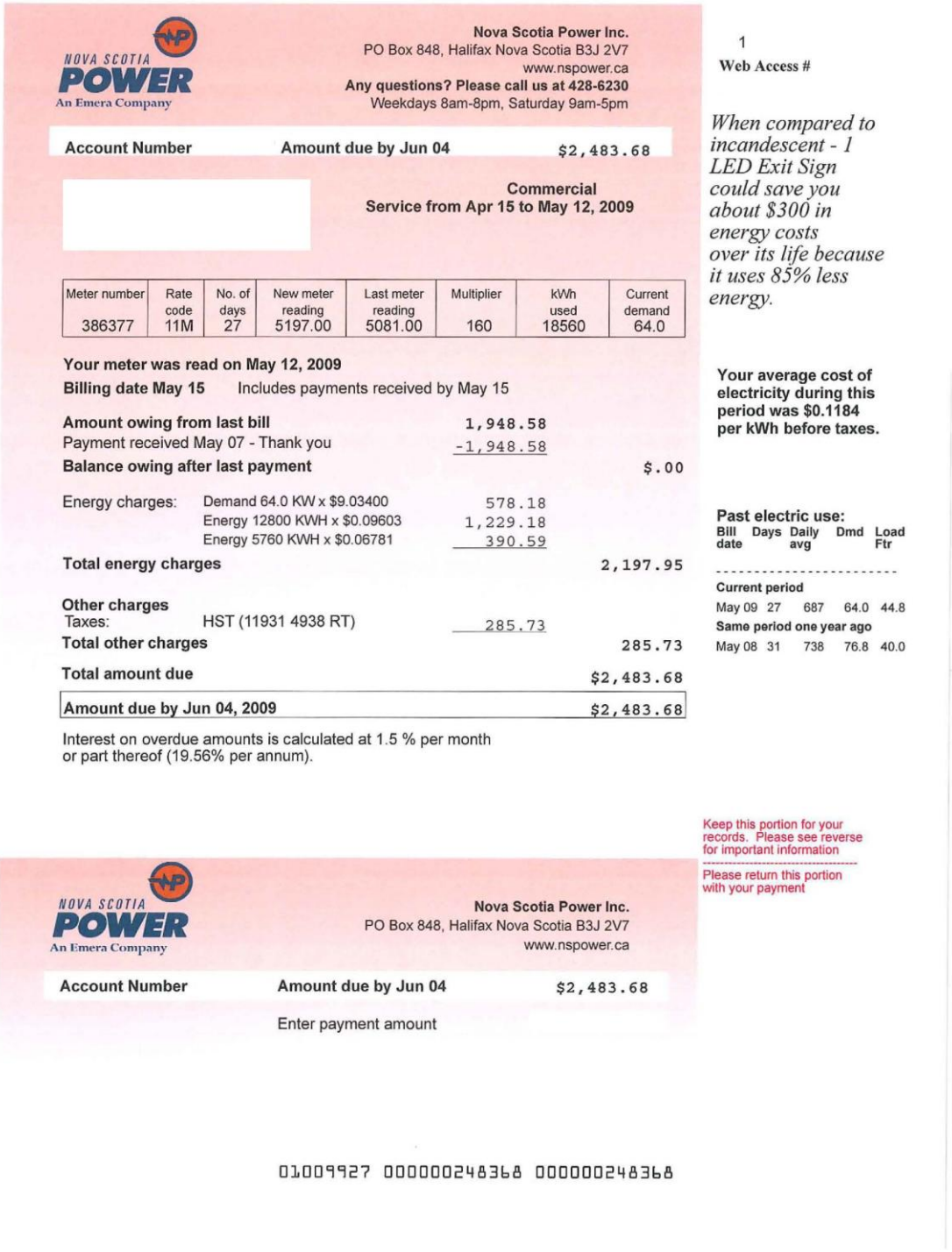
Kilowatt (kW) is a unit of power. 1 kilowatt = 1000 watts.

KWh stands for kilowatt hour. Electricity is measured in kilowatt hours. One kilowatt hour (kWh) is 1,000 watts of electricity consumed for one hour. For example, one 100 watt light bulb burning for 10 hours would use one kWh of electricity.

Meter readings determine the amount of electricity you have used. Subtract the ‘last meter reading' from the ‘new meter reading' to get the number of kilowatt hours consumed since your last bill. Contact Nova Scotia Power for information on how to read your meter.

Multiplier extends the recording capability of some meters. For example, a meter with a multiplier of 10 registers one unit for every 10 kWh consumed. To get the actual number of kWh's used over a billing period, subtract the ‘last meter reading' from the ‘new meter reading' and multiply the difference by the ‘multiplier' shown on the bill.

You have now really looked at a bill at the individual consumer level, now take a look at the NSP bill from the commercial customers perspective.



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1
Web Access #

When compared to incandescent - 1 LED Exit Sign could save you about $300 in energy costs over its life because it uses 85% less energy.

Account Number **Amount due by Jun 04** $2,483.68

Commercial
Service from Apr 15 to May 12, 2009

Meter number	Rate code	No. of days	New meter reading	Last meter reading	Multiplier	kWh used	Current demand
386377	11M	27	5197.00	5081.00	160	18560	64.0

Your meter was read on May 12, 2009
Billing date May 15 Includes payments received by May 15

Amount owing from last bill		1,948.58	
Payment received May 07 - Thank you		-1,948.58	
Balance owing after last payment			$.00
Energy charges:	Demand 64.0 KW x $9.03400	578.18	
	Energy 12800 KWH x $0.09603	1,229.18	
	Energy 5760 KWH x $0.06781	390.59	
Total energy charges			2,197.95
Other charges			
Taxes:	HST (11931 4938 RT)	285.73	
Total other charges			285.73
Total amount due			$2,483.68
Amount due by Jun 04, 2009			$2,483.68

Interest on overdue amounts is calculated at 1.5 % per month or part thereof (19.56% per annum).

Your average cost of electricity during this period was $0.1184 per kWh before taxes.

Past electric use:

Bill date	Days	Daily avg	Dmd	Load Ftr
Current period				
May 09	27	687	64.0	44.8
Same period one year ago				
May 08	31	738	76.8	40.0

Keep this portion for your records. Please see reverse for important information

Please return this portion with your payment

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Account Number **Amount due by Jun 04** $2,483.68

Enter payment amount

01009927 000000248368 000000248368

How does a residential and a commercial bill differ?

Demand is the rate at which electricity is being used at a given time. Demand is often measured in kilowatts (kW). Many commercial and industrial

customers' bills include charges for peak demand recorded on a demand meter. Only sustained demands fully register on the meter.

Demand charge is the amount that general service and industrial customers pay Nova Scotia Power to cover the cost of building and maintaining the generation, transmission and distribution capacity to meet their maximum demand for electricity. This amount does not include energy charges.

The Province of Nova Scotia has come up with a plan for how to responsibly use, manage and produce energy.

Research online to find a copy of the report, "**Toward a Greener Future: Nova Scotia's Climate Change Action Plan**"

Hint: The report was originally posted through the Provincial Government web site...

https://www.gov.ns.ca/energy/resources/spps/energy-strategy/Energy-Strategy-2009.pdf

Review this report. How do the recommendations for our province relate to you?

	**Looking Forward: APPLICATION & ACTION**

Think about these general activities and action avenues.

A first important step in this process will be for you to conduct a personal energy audit.

Take Action: Conduct A Personal Energy AUDIT

Take action to create and conduct a personal Energy Audit. Consider your own interactions with energy. Integrate in your audit how you currently use and consume energy. Consider the action steps you envision taking (or are already taking) relating to the responsible use, management, production and consumption of energy.

When looking at possible action options, total energy utilization can be impacted by educational interventions, technological interventions, and the combination of technological and educational interventions (Source: "**Dollars to Sense Energy Master Plan**" report from Natural Resources Canada).

Obviously, when considering what action avenues to take, there are all kinds of options possible. If the sky is the limit with budget then you have all kinds of choices. It often works best to start with the no-cost or low cost solutions first. Keeping it simple is a premise that applies to many situations in life, including energy considerations.

Take advantage of opportunities to engage in further dialogue with your co-learners and your facilitator about what you have been reading and discovering in the course to date.

- **In addition to what you submit to your facilitator, you are also encouraged to participate in formal and informal dialogue opportunities with co-learners. Discuss the following question: How did this module impact YOU?**

Assessment

In order to receive credit for this module, you are required to submit to your facilitator your energy audit artefact as well as a single page learning reflection. This reflection must include the components outlined below and fit on one single letter size page with a minimum 10 point type font.

- **Module Name:**
- **Learner Name:**
- **How did this module INFORM?** Based on your module readings, reflections and collaboration with others, provide a one paragraph summary of how the content from this module has informed you relating to the importance of sustainability action. What is the single most important thing you learned from this module?
- **How did this module INFLUENCE?** Knowledge is one thing, but learning takes on deeper meaning when it is reflected upon and shared. Throughout this module you have been encouraged to discuss, reflect, share and collaborate with other learners in your journey through the content and activities. Provide one paragraph of reflection evidence indicating how others helped to evolve your attitudes and /or how you have helped to change the attitudes of others.
- **How did this module INSPIRE?** Knowledge and attitudes are important but actions and behaviours are where change often most noticeably happens. Really think about the things you can do (and are already doing). Sum up the personal action steps you are currently completing and/or plan on taking based on this module.
- **Your learning is documented in many forms. Your submitted reflection pieces and the different pieces of evidence from the learning activities you completed are all important artifacts of your learning – they are representations of what and how you have learned.**
- **Your lifelong learning and action to help create a more sustainable future continues on from here…**